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Key to Field Identification of Anadromous Juvenile Salmonids in the Pacific Northwest

ROBERT J. McCONNELL and GEORGE R. SNYDER

SEATTLE, WA.
January 1972

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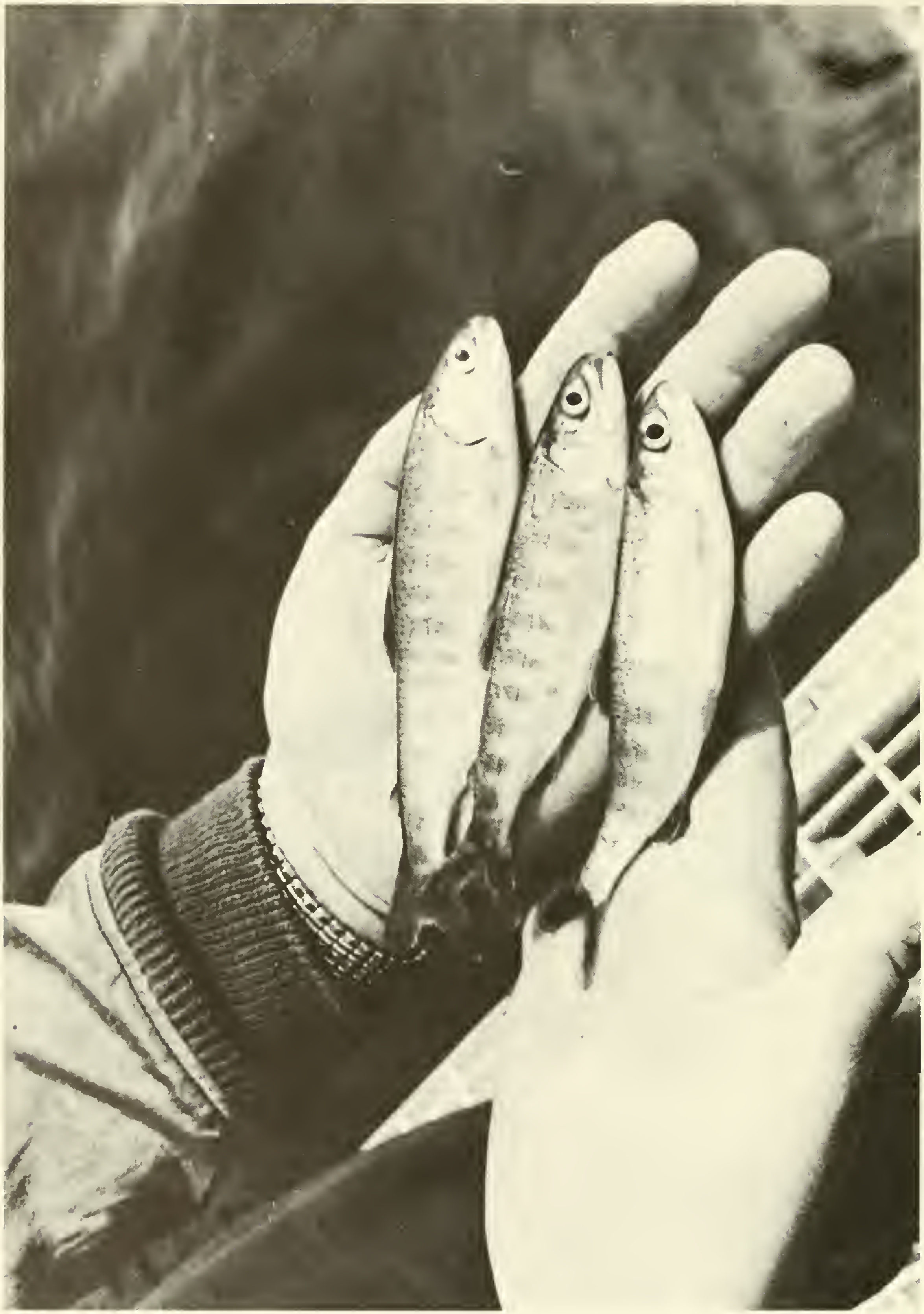

Fingerling silver salmon (*Oncorhynchus kisutch*).

(Photograph by Warren Andersen, The Tacoma News Tribune, Tacoma, Wash. 98401)

Key to Field Identification of Anadromous Juvenile Salmonids in the Pacific Northwest

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ABSTRACT

A key is presented with descriptive illustrations to help in field identification of live, juvenile salmonids in fresh waters of the Pacific Northwest. Other juvenile fish that may be mistakenly identified as salmonids are included.

INTRODUCTION

Species identification of live, anadromous juvenile salmonids is frequently a problem to the field biologist. The purpose of this key is to list and illustrate the external characteristics which will expedite field identification of juvenile salmonids in the Pacific Northwest.

Five species of Pacific salmon (pink, chum, sockeye, chinook, and coho); four species of trout (cutthroat, brown, Dolly Varden, and rainbow or steelhead); and other juvenile and adult fish [1] that may be mistaken for salmon or trout in fresh water are described in this key.

USE OF KEY

The characteristics for identification are listed in a series of alternative statements, some of which are illustrated. To use the key, examine the first statement; if applicable, proceed to the next and continue to successive statements until the species is identified. If a statement is not applicable, pass to the alternative characteristics indicated by numbers in parentheses (numbers on the drawings correspond to numbers of statements in the key). Continue in this manner until the specimen is identified. Some external characteristics are positive separating features (marked with asterisk), whereas others are not. Therefore, two or more statements should be considered before final rejection. If a precise identification cannot be made using the external characteristics —and the fish can be sacrificed, a positive identification can usually be made from internal features (marked with double asterisks). A bibliography of keys that utilize more descriptive internal characteristics is included in this paper.

KEY

1. (47) Adipose fin and scales present. (Fig. 1)
2. (48) Fleshy appendage at base of pelvic fins present.
3. (49) Mouth large, reaching at least to center of eye.

Family Salmonidae

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[1] Especially adult smelt, family Osmeridae.

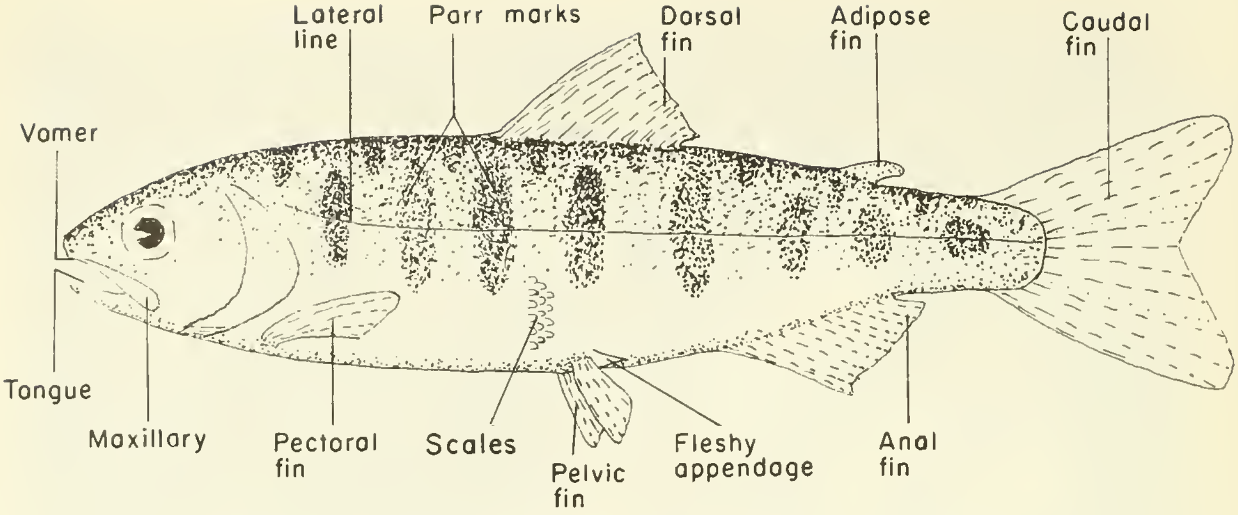


Figure 1.—A hypothetical salmonid showing external characteristics.

4. (17) Anal fin higher than long, with 8 to 12 developed rays (Fig. 2A)

5. (52) *Teeth on head and shaft of vomer. (Fig. 3A)

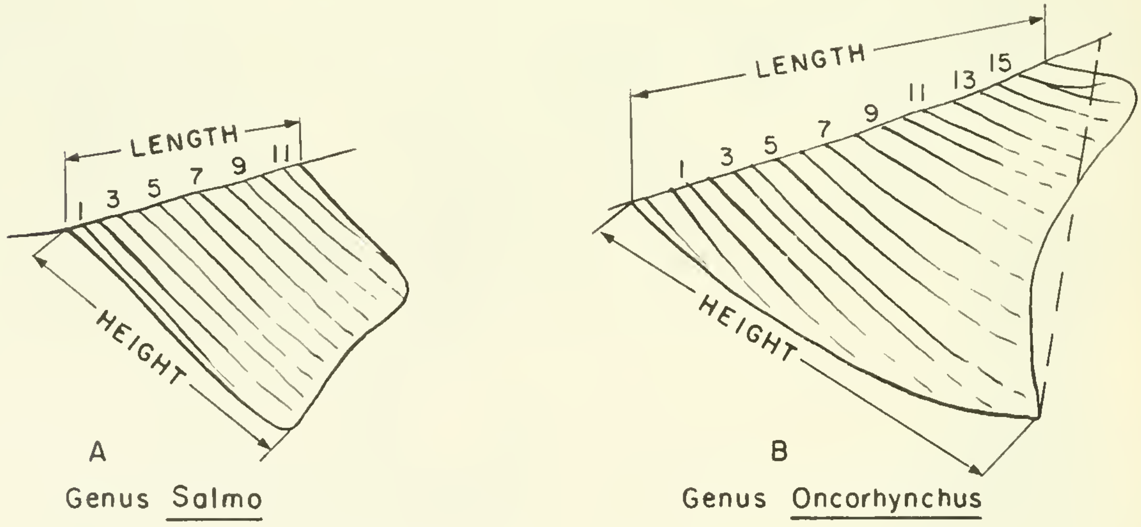


Figure 2.—Anal fins: (A) Trout, genus *Salmo;* (B) Pacific salmon, genus *Oncorhynchus.* The two drawings show differences in structure and fin ray count. (Note that the length of the anal fin is its overall basal length, and its height is that distance from the origin of the fin to the tip of the anterior lobe. In counting fin rays, include only those which originate from the base and terminate at the outer margin of the fin or are half as long as [or greater than] the longest ray.)

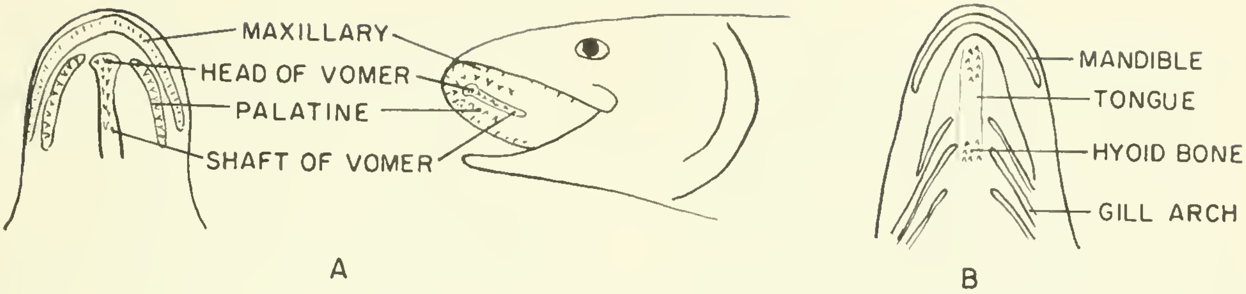
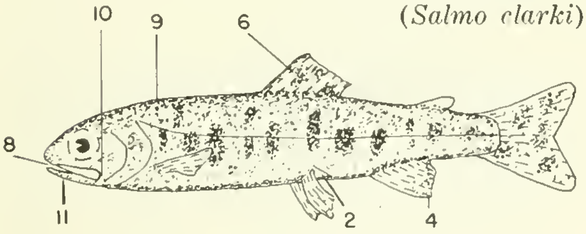


Figure 3.—Location of dentition in (A) the roof and (B) the floor of the mouth of salmonid fishes. (Presence or absence of teeth on the vomer or tongue may be determined by use of the little finger or a blunt instrument. The small hyoid teeth at the base of the tongue are located between the gill arches of the lower jaw and are difficult to find.)

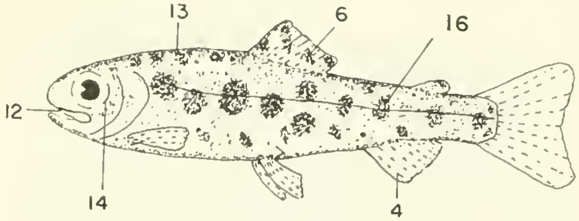
6. (18) Dorsal fin with large dark spots.
Trout
Genus *Salmo*

7. (53) Adipose fin not orange; no row of pale round spots along lateral line.
8. (12) *Small hyoid teeth at base of tongue. (Fig. 3B)
9. (13) Not more than five parr marks on mid-dorsal ahead of dorsal fin.
10. (14) Maxillary reaching past posterior margin of eye.
11. (15) Red or yellowish hyoid mark under lower jaw. Tail usually black spotted.
Cutthroat trout
(*Salmo clarki*)



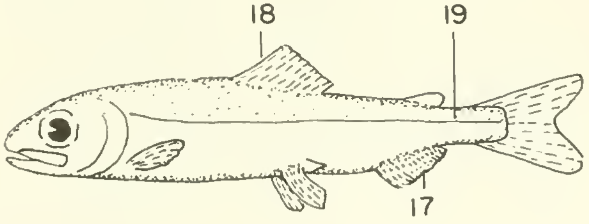
12. (8) *No teeth at base of tongue.
13. (9) Five to 10 parr marks along mid-dorsal ridge ahead of dorsal fin.
14. (10) Maxillary short, not reaching past posterior margin of eye.
15. (11) No hyoid mark under lower jaw. Few or no spots on tail.

16. (20) Parr marks almost round.
Rainbow or
steelhead trout
(*Salmo gairdneri*)



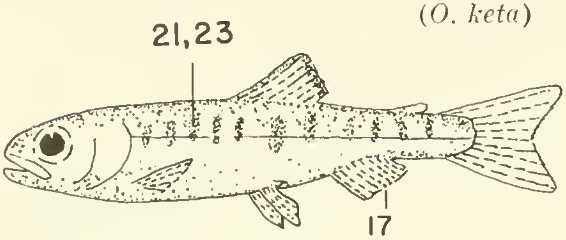
17. (4) Anal fin longer than high, with 13 or more developed rays. (Fig. 2B)
18. (6) Dorsal fin without large dark spots, may be black tipped.
Pacific salmon
Genus *Oncorhynchus*

19. (20) No parr marks. Fry leave fresh water while small—approximately 1.75 inches (45 mm) long.
Pink salmon
(*O. gorbuscha*)



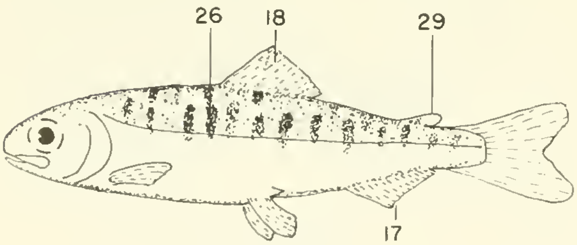
20. (16) Parr marks present as vertical bars or oval spots.
21. (30) Parr marks short, extending little, if any, below lateral line.
22. (25) Gill rakers on first arch, 19 to 26. ** Pyloric caeca, 140 to 186.
23. (26) Parr marks faint. Sides below lateral line iridescent green.
24. (27) Small when migrating from fresh water, approximately 1.5 inches (40 mm) long.

Chum salmon
(*O. keta*)



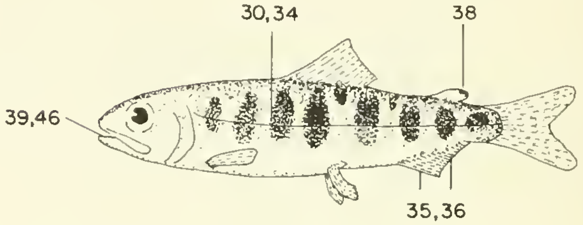
25. (22) Gill rakers on first arch, 30 to 40. **Pyloric caeca 60 to 115.
26. (23) Parr marks usually sharply defined. Sides below lateral line silvery, not iridescent green.
27. (24) Relatively large when migrating from fresh water, approximately 3 to 5 inches (80 to 126 mm) long.
28. (31) Gill rakers long and slender, more than 29 on first arch.
29. (32) Adipose fin clear, not pigmented.

Sockeye salmon
(*O. nerka*)



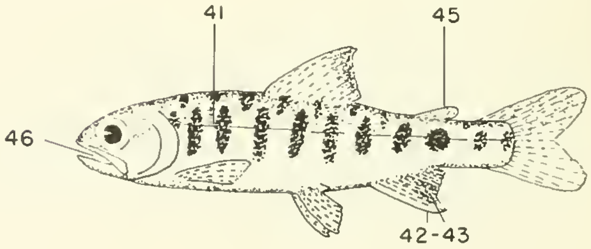
30. (21) Parr marks large, vertical bars centered by lateral line.
31. (28) **Gill rakers short and thick, fewer than 29 on first arch.
32. (29) Adipose fin at least partially pigmented.
33. (40) **Plyloric caeca more than 90.
34. (41) Parr marks broader than interspaces.
35. (42) Anterior rays of anal fin not distinctly longer than rest, not white edged.
36. (43) Anal fin not pigmented.
37. (44) Black spots, when present, on both lobes of caudal fin.
38. (45) Adipose fin not completely mottled, clear area at anterior base of fin.
39. (46) Black gums along base of lower teeth.

Chinook salmon
(*O. tshawytscha*)



40. (33) **Plyloric caeca less than 80.
41. (34) Parr marks narrower than interspaces.
42. (35) Anterior rays of anal fin elongated; when depressed they extend to base of last ray. (Fig. 2B)
43. (36) Anal fin pigmented between rays, resulting in black banding.
44. (37) Black spots, when present, on upper lobe of caudal.
45. (38) Adipose fin completely pigmented.
46. (36) Mouth gray to white.

Coho salmon
(*O. kisutch*)



47. (1) Adipose fin not present; scales present or lacking.
Not Salmonidae

48. (2) No fleshy appendage at base of pelvic fins.
Smelts
Family Osmeridae

49. (3) Mouth small, not reaching center of eye; teeth weak or absent.

50. (51) Depressed dorsal fin, shorter than head.
Whitefishes
Genus *Coregonus*

51. (50) Depressed dorsal fin, longer than head.
Arctic grayling
(*Thymallus arcticus*)

52. (5) **Teeth on head of vomer only.
Chars
Genus *Salvelinus*
Dolly Varden (*S. malma*)

53. (7) Adipose fin orange; row of distinct pale round spots along lateral line.
Brown trout
(*Salmo trutta*)

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We especially thank Dr. Arthur D. Welander, Professor of Fisheries, and Dr. Bruce S. Miller, Research Biologist, College of Fisheries, University of Washington, Seattle, for their valuable suggestions. We also thank Galen H. Maxfield, Fishery Biologist, and Dr. Alan J. Beardsley, Fishery Biologist, both from the NMFS Northwest Fisheries Center, Seattle.

BIBLIOGRAPHY

Alaska

MEEHAN, W. R., and J. S. VANIA.
1961. An external characteristic to differentiate between king and silver salmon juveniles in Alaska. Alaska Dep. Fish Game, Inf. Leafl. 1. 5 p. (Processed.)

WILIMOVSKY, N. J.
1958. Provisional keys to the fishes of Alaska. U.S. Fish Wildl. Serv., Fish. Res. Lab., Juneau, Alaska. 113 p. (Processed.)

California

SHAPOVALOV, LEO.
1947. Distinctive characters of the species of anadromous trout and salmon found in California. Calif. Fish Game 33: 185-190.

Canada

CARL, G. CLIFFORD, W. A. CLEMENS, and C. C. LINDSEY.
1967. The fresh-water fishes of British Columbia. B. C. Prov. Mus., Dep. Recreation Conserv., Handb. 5. 192 p.

CLEMENS, W. A.
1935. The Pacific salmon in British Columbia waters. B. C., Rep. Comm. Fish. 1934: K103-K105.

CLEMENS, W. A., and G. V. WILBY.
1946. Fishes of the Pacific Coast of Canada. Fish. Res. Board Can., Bull. 68. 368 p.

FOERSTER, R. E., and A. L. PRITCHARD.
1935. The identification of the young of the five species of Pacific salmon, with notes on the fresh-water phase of their life-history. B. C., Rep. Comm. Fish. 1934: K106-K116.

SCOTT, W. B.
1958. A checklist of the freshwater fishes of Canada and Alaska. R. Ont. Mus., Div. Zool. Palaeontol. 30 p.

Montana

WEISEL, G. F.
1957. Fish guide for intermountain Montana. Mont. State Univ. Press, Missoula. 88 p.

Oregon

BOND, CARL E.
1961. Keys to Oregon fresh-water fishes. Oreg. State Univ., Agric. Exp. Stn., Tech. Bull. 58. 42 p.

Pacific Northwest

BURGNER, R. L. (edited by William A. Smoker).
1955. Preliminary key for identification of salmon fry, juveniles, and adults. State of Wash., Dep. Fish. 8 p. (Processed.)

GREGORY, R. W., P. E. FIELDS, R. W. LICHTENHELD, and G. R. SNYDER.
1961. Using anal chromatophores for distinguishing between chinook and silver salmon smolts in the Columbia River. Coll. Fish., Univ. Wash., Seattle, Tech. Rep. to U.S. Army Corps Eng. No. 51. 4 p. (Processed.)

ROUNSEFELL, G. A.
1962. Relationships among North American Salmonidae. U.S. Fish Wildl. Serv., Fish. Bull. 62: 235-270.

SCHULTZ, LEONARD P.
1936. Keys to the fishes of Washington, Oregon and closely adjoining regions. Univ. Wash., Publ. Biol. 2: 103-228.

Washington

CRAWFORD, DONALD R.
1925. Field characters identifying young salmonid fishes in fresh waters of Washington. Univ. Wash., Publ. Fish. 1(2): 64-76.

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349. Use of abstracts and summaries as communication devices in technical articles. By F. Bruce Sanford. February 1971, iii + 11 pp., 1 fig.

350. Research in fiscal year 1969 at the Bureau of Commercial Fisheries Biological Laboratory, Beaufort, N.C. By the Laboratory staff. November 1970, ii + 49 pp., 21 figs., 17 tables.

351. Bureau of Commercial Fisheries Exploratory Fishing and Gear Research Base, Pascagoula, Mississippi, July 1, 1967 to June 30, 1969. By Harvey R. Bullis, Jr., and John R. Thompson. November 1970, iv + 29 pp., 29 figs., 1 table.

352. Upstream passage of anadromous fish through navigation locks and use of the stream for spawning and nursery habitat, Cape Fear River, N.C., 1962-66. By Paul R. Nichols and Darrell E. Louder. October 1970, iv + 12 pp., 9 figs., 4 tables.

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